Remedial Strategy
Former Northern Globe Site
22 Sydenham Street
Brantford, Ontario

Prepared for:
Mr. Lyle Long
Corporation of the City of Brantford
100 Wellington Square
Brantford Ontario
N3T 5R7

Trow Associates Inc.

108 George Street
Brantford, Ontario N3T 2Y4
Telephone: (519) 754-1648
Facsimile: (519) 754-0905

April 7, 2004

Table of Contents

1. Introduction

Trow Associates Inc. (Trow) is pleased to present you with our understanding of the on-Site conditions and potential costs which maybe associated with remediation of the former Northern Globe property, located at 22 Sydenham Street in Brantford, Ontario.

Trow's understanding of the subsurface soils and groundwater conditions on-Site is based on our review of the following documents provided to Trow by the City of Brantford:

- Golder Associates Ltd. (Golder), "Phase II Environmental Assessment Domtar Construction Materials", dated February, 1991 (Reference No. 911-6033);
- Belko Group (Belko), "Phase II (Supplement) 22 Sydenham Street- Former Northern Globe Site", dated January 5, 2002 (Reference BK-2001-12.027); and
- Belko, "Phase II (Supplement) 22 Sydenham Street- Former Northern Globe Site", dated May 15, 2002 (Reference BK-2001-12.029).

The scope of work and significant findings detailed in the above noted reports is as follows.

1.1 Golder Report

According to the Golder report, the Phase II Environmental Site Assessment (ESA) was conducted to facilitate the sale of Domtar's roofing division. The areas of potential environmental concern highlighted in this report were:

- "45 gallon drums containing di-n-butyl phthalate, ethylene glycol, trichloroethylene (TCE), ammonia and Therminol 55;
- The above ground asphalt storage tanks near BH-8 and the liquid asphalt loading bay new AH-4;
- A line of former above ground gas oil storage tanks running from the area of the Plant #3 addition towards the rail lines;
- Asphalt pits near the location of BH-2;
- A former wooden, below ground tank in the area of the dust collector which was removed during the mid 1980's;
- An 18 foot deep, concrete line felt dipping trough, subsequently filled with debris and concrete, located at the west side of Plant 1 north of the felt room, and adjacent to the current above ground dipping trough;
- A buried gasoline tank in the area of BH-6;

- An electrical substation east of the BH-8 location;
- A storage area of 45 gallon drums containing di-n-butyl phthalate, ammonia, and ethylene glycol against the site fence south of the Emulsion Plant;
- A storage area of two 45 gallon drums containing TCE in the Warehouse area just south of Plant 1; and
- Beneath the building floor slabs."

The significant findings pertaining to the environmental quality of this property can be summarized as follows:

- "The clayey silt units found beneath the Domtar Brantford site are discontinuous, and contain hydraulic "windows" to the deeper granular zones.
- The groundwater flow direction in both the shallow and deep groundwater zones are from north to south. There is a slight downward vertical hydraulic gradient across the clayey silt unit which underlies the north half of the Domtar Site.
- No evidence of floating free phase product or denser than water free phase product was found in any monitoring well.
- The granular fill material, both below the main asphalt yard areas and the concrete floor slabs in the buildings, can be characterized, in general, as containing concentrations of cobalt in excess of MOE decommissioning and clean-up guidelines for industrial Sites. The sources of the high cobalt concentrations in the surficial soils at the Site are unknown, and are presumably unrelated to present plant operations. At several specific locations around the Site (asphalt storage tanks, above ground storage tanks, and felt room) the surficial fill materials contain concentrations of oil and grease in excess of the MOE guidelines. Other metal concentrations (arsenic, cadmium, copper, lead, nickel and zinc) in the surficial fill material beneath the main yard area of the Site, and beneath the warehouse (1958) and pump room buildings, exceed MOE guidelines at various specific locations.
- The elevated metal concentrations, excluding cobalt, in the surficial soils at the Domtar Site are probably related to the "granules" used in the manufacturing of shingles. The "granules" are produced from crushed heavy metal-rich smelter slag.
- A buried concrete structure covered by sand fill containing asphalt, wood and shingle fragments is located beneath the floor slab in the northwest corner of Plant #1;
- Chrysene concentrations in one surficial fill sample collected in the vicinity of the above ground storage tanks exceed MENVIQ C- Level guidelines. Benzo (a) pyrene concentrations were detected in two surficial soils at AH-4 (4.8 ppm) and GS-1 (0.8 ppm), both were well below the MENVIQ guideline of 10 ppm.

- The shallow and deep groundwater at the site contain concentrations of iron, manganese, lead, sodium and at one location chloride above Ontario Drinking Water Objectives (ODWO) guidelines. The iron and manganese concentration in the Brantford area groundwater typically naturally exceed ODWO guidelines, and the elevated sodium concentrations and associated chloride concentrations, particularly in the shallow groundwater are probably related to de-icing salt applications to the yard areas and possibly off-Site salt migration onto the Site. No cobalt was detected, above detection limits, in the groundwater samples collected and submitted for analyses during the Phase I and II programs. The lead concentrations could possibly be related to plant activities.

- Based on the 1991 Phase II results, PAHs are present in trace concentrations (Total PAH less than 1 ppb) in the deep groundwater zone at the Well 9A and 16A location. Elevated concentrations of PAH's in the shallow groundwater zone at Well 7 (total PAH of 208.1 ppb) during the 1990 Phase I program appears to be related to surface water entering the well prior to sampling as re-testing of groundwater from this well in 1991 did not indicate any PAH concentration. Re-testing of Well 9 in 1991 did not indicate any PAH concentration (1990 total PAH of 1.4 ppb in the groundwater sample from Well 9).

- Concentration of di-n-octylphthalate were found in the groundwater samples collected during the 1990 Phase I program at the Well 5 (114 ppb) and 8 (6.1 ppb) locations. Sampling of the groundwater from Well 5A in 1991 did not indicate any detection of phthalates. During the 1991 Phase II program, bis(2-ethylhexyl) phthalate concentrations were found in the groundwater samples from Wells 9A (2.4 ppb), 12 (2.7 ppb) and 16B (2.1 ppb). Also reported during the Phase II analysis program, two laboratory reagent blanks (distilled water) indicating bis(2-ethylhelyl)phthalate concentrations from 2.4 to 3.1 ppb.

- Elevated TCE concentrations in the groundwater are found along the downgradient boundary of the Site. At well 14A, the concentration of TCE (54.6 ppb) in the groundwater sample exceeds the recently implemented (1990) MOE Ontario Drinking Water Objective (ODWO) maximum acceptable concentration (MAC) guideline of 50 ppb. It should be noted that there are no recorded users of groundwater in the area downgradient of the Domtar Site between the Site and the Grand River. There is no intent to suggest that the groundwater at this Site must meet, or be remediated to ODWO guidelines.

Reference to a previous Preliminary Phase I Soil and Groundwater Investigation completed by Golder in 1990 was made. This report was not available for Trow's review.

Subsequent to a fire in 2001, the City of Brantford took control of the Site and retained Belko to delineate the extent of the environmental contaminants identified in the Golder Report.

1.2 Belko Reports

The Phase II ESA completed by Belko in October, 2001 consisted of the advancement of five boreholes equipped with monitoring wells and the excavation of six test pits. The significant findings of this Phase II ESA include:

- No groundwater impacts in excess of Table B guidelines were identified during the sampling conducted during this ESA. Minor parameter exceedances noted during the Golder ESA were not duplicated during this investigation. No remediation of groundwater is likely to be required based on known conditions. The shallow groundwater samples at the extreme down-gradient end of the Site (MW-15) did not reveal any parameter exceedances or significantly elevated concentrations. Based on this information the probability of off-Site impacts being generated in the near future is fairly remote.

- Exceedance of the TPH parameter was noted in BH/MW3, BH/MW4 and BH/MW5 during this investigation. These areas appear to be the result of two separate contamination issues. The sample from BH/MW3 and BH/MW5 were shallow soil samples from a layer approximately 0.3-1.0 mbgl while the sample from BH/MW4 was noted from 2.0-2.8 mbgl. The shallow impacts are estimated to represent an area of 400 m^2 squared. Assuming a depth of impact of 0.7 m over that area, a total volume of impacted soil of 280 m^3 is determined for this area. The deeper soil impacts noted at BH/MW4 is estimated to cover an area of approximately 400 m^2 and is about 1.0 m in depth therefore creating a volume of impacted soils of 400 m^3.

- Investigations conducted by Golder and Belko beneath the floor slabs of the buildings identified heavy-metal impacted soil. Also, cinders, shingles, ash, tar pockets, coal, slag, etc. was noted in the fill soils beneath the building. Assuming a fill depth of 2.0 m beneath each building and the following building areas, a total estimated quantity of impacted soil beneath the building is 22,460 m^3. Plan #1 (including felt room and pump room) 3,480 m^2, Plant #3 (including all three sections) 2,050 m^2 , Warehouse Building (including two sections) 5,100 m^2 , and Emulsion Plant 600 m^2 . It should be noted that during the Golder investigation most of the shallow fill samples submitted for metals analysis exceeded the guideline for cobalt while none of the samples submitted during this investigation indicated even elevated cobalt levels. Further, the boron parameter identified at elevated levels in the sub-floor slab fills, is known as a "problem" parameter. Naturally elevated boron concentrations, poor repeatability of test results (on the order of magnitudes of difference) and a method detection limit that is actually higher than the guideline value have all proven to be problems during other investigations. Groundwater samples analyzed for boron parameter show background-like concentrations and may indicate that the soil concentrations measured could be erroneous or inaccurate near the method detection limit. We would recommend that before these shallow fill soils are removed for off-Site disposal, some further metals analyses be conducted on the soils to confirm and further delineate the areas of impact. The soils beneath the buildings at depths of between 0.6 to 1.2 mbgl contain materials

(coal, shingles, tar, etc.) that would be classified as "waste" materials and will require disposal.

- If industrial or commercial land uses are considered for redevelopment, the volume of soils requiring remediation would be greatly reduced. Several soil samples that exceeded the residential criteria would actually meet the industrial/commercial land-use criteria. In fact, if the redevelopment were to keep the Site in its present land-use category, there is no requirement within the guidelines to currently remediate the Site to the guideline levels."

Based on the inconsistencies in the data between the Golder investigation and Belko 2001 investigation, a second Phase II ESA was completed by Belko (May, 2002)to confirm the presence/absence of cobalt and boron in the shallow soils. The significant findings of this additional testing include:

- "The results of the laboratory analyses conducted during this investigation indicate that no exceedances of the cobalt parameter determined for any of the forty samples analyzed. In fact, the concentrations measured for cobalt do not even reflect elevated levels of cobalt. Based on this information, it would appear that the cobalt levels identified during the 2001, and this current, investigation support this conclusion. The cobalt exceedences reported by Golder might have been induced by the sampling method utilized during their assessment. Further consideration of cobalt is not required.

- The concentration of hot water extractable boron determined for the six samples submitted during this investigation indicated that they would meet the MOEE Table B guideline for both residential/parkland and industrial/commercial criteria."

2 Trow's Opinion

Based on our review of the reports prepared by others, it is Trow's opinion that the following major environmental issues are present on-Site:

- The test data indicates that heavy metal impacts in the near surface soils across the Site and underlying the Site buildings is the major environmental concern. The average depth of this contamination appears to be less than 0.6 m. However, a deeper pocket of heavy metal impacted soil at a depth of 1.8 m bgs was observed in the south central portion of the Site. Due to a lack of reproducibility in the data between the Golder 1991 and the Belko 2001 reports, the actual extent of the heavy metal impact on-Site is questionable.

- Two areas of PAH contamination have been identified in the near surface soils. The first area is along the railway track, and the second area is south of the former pump building in the central portion of the Site.

- Two main pockets of TPH gas/diesel and heavy oil impacted soils were identified in the vicinity of the existing five underground storage tanks (USTs) and south of the former asphalt storage tanks. A third pocket of TPH heavy oil impacted soil was identified in the northern portion of the Site, east of the granule storage area. Some concentrations in the surface soils were also identified in the Golder report.

- Table B criteria for TPH gas/diesel do not exist. However, an elevated concentration of TPH (9,900 µg/L) was reported in a groundwater sample collected from MW4.

2.1 Remedial Option #1 - Dig and Dump

Based on our review of the above noted data, Trow presents the following first order remedial approaches and cost estimates for your consideration. The first approach is based on the conventional "dig and dump" method to remediate the Site to meet the MOE's Table B criteria for residential/parkland use.

It should be noted that to develop a detailed Remedial Action Plan (RAP), additional testing is required. The approach and costs discussed below are based on our understanding of the Site conditions at this time. If additional contamination is encountered during future investigations, the approach and costs would have to be revised to reflect these additional areas of contamination.

The proposed dig and dump remedial approach would involve the following:

- Removal of the all five UST's.

- Removal of existing floor slabs, footings and foundations. Excavation and off-Site disposal of contaminated soils above residential/parkland or commercial/industrial criteria found in Table B.

- The excavation of impacted soils will occur using on-Site screening of the soils for heavy metals using an XRF analyzer. Since the data suggest that some areas of the Site are free of heavy metals impact the use of the XRF field screening technology will greatly reduce the remediation costs. A gas tech will be used to field screen the soils in the TPH impacted zones.

- The estimated volume of soil requiring off-Site disposal is 27,600 tonnes. This is considerably less than the 30,000 m^3 presented in the Belko estimate. Please note that we anticipate that further reduction in the volume of soil requiring removal can be achieved through the use of the XRF field screening technology. This assumes the entire site will be excavated to a depth of approximately 0.6 m below grade. Based on the data review, there appear to be some portion of the Site that are not impacted and a few pockets of impacted material that extends to a depth of approximately 3 m. However, the majority of the heavy metal impacted soil has been identified at depths of approximately 0.3 m and we believe our assumption is reasonable.

- Restoration of the Site to existing grade, pending future development would also be done.

Based on the above noted scope of work and assessment limitations, the following cost estimate has been formulated.

Table 1: Cost Estimate- Dig and Dump

Task	Cost
UST removal	$40,000.00
Floor slab, foundation and footing removal	$220,000.00
Contaminated soils remediation, engineering, sampling and site restoration (27,600 tonnes @ $80.00/ tonne)	$2,208,000.00
Total	**$2,468,000.00**

Note: Prices do not include applicable taxes.

2.2 Remedial Option #2- Site Specific Risk Assessment Approach

It is Trow's understanding that all of the Site maybe designated as parkland. Under the assumption that ownership of parkland would be retained by the City of Brantford, the completion of a Site Specific Risk Assessment (SSRA) may be a viable option. Lands which undergo an SSRA are not suitable for future residential use.

It should be noted that to complete a SSRA, additional testing is required. The following approach and costs are based on our understanding of the Site conditions at this time. If additional contamination is encountered during future investigations, the approach and costs would have to be revised to reflect this additional information.

The provisions for the completion of SSRA's is included in the Ministry of Environment's (MOE's) document entitled "Guidelines For Use At Contaminated Sites in Ontario", revised February, 1997. In this document, the MOE outlines the SSRA approach maybe used instead of the background or generic approaches, which rely upon existing soil or groundwater quality criteria. The above noted MOE document describes a SSRA as, "a scientific tool which estimates the health risk posed to humans, plants, wildlife and the natural environment from exposure to a contaminant." It should be noted that the level of health protection provided remains the same as that provided by the generic criteria.

The SSRA process provides information to site owners, consultants and others to use when assessing the environmental condition of a site to determine whether or not remediation is required and the nature and extent of remediation to allow the continued use or reuse of the site. Since the study area consists of multiple contaminants which are site-wide and involve both soil and groundwater media, the incorporation of the SSRA would become an integral part of the redevelopment of the property.

The SSRA approach under the MOE guideline is both a process and an administrative mechanism for:

1. determining a level of exposure protection for an individual site;

2. establishing risk-based criteria for an individual site; and

3. assessing human and ecological risk.

Selection of the most appropriate clean up level, if required, is a decision made by stakeholders to best suit their needs and the environmental, human health and contamination considerations for the subject site. This approach includes both risk assessment and risk management.

The MOE Guideline distinguishes between two types of risk management decisions, termed Level 1 and Level 2. The Level 1 SSRA approach includes considerations that were generally followed in the development of generic criteria such as the use of Upper Concentration Limits (UCL).

Changing the Level 1 risk or any other Level 1 considerations would be considered a Level 2 approach. The Level 2 Risk Management approach involves use of mechanisms or techniques for reducing, eliminating or blocking exposure pathways. This approach would involve conducting of a human health risk assessment in conjunction with engineered barriers and systems to reduce potential exposures to acceptable levels for the proposed land use.

The administrative requirements for a SSRA approach include an independent third party peer review, MOE review and concurrence with the findings of the risk assessment, and with the

implementation of the recommendations of the risk management plan, and the registration of a Certificate of Prohibition on title to the land (Level 2).

Trow's SSRA approach would involve the following:

- Removal of all five UST's;
- Removal and off-Site disposal of approximately 3,000 to 4,000 tonnes of TPH and PAH impacted soil;
- Restoration of the excavated areas;
- Completion of additional testing and submission of SSRA to the MOE.

It should be noted that the outcome of the SSRA may require the placement of a clay cap to eliminate human exposure pathways. The cost of this clay cap, depending on the availability of material, may be between $200,000 to $400,000. This cost can be considered as part of the development costs to convert the Site to parkland (i.e. landscaping, placement of sod). If the ultimate use of the Site changes (i.e. parking lot) then the asphalt cover would be a suitable alternative to the clay cover. Based on the above noted scope of work and assessment limitations, the following cost estimate has been formulated.

Table 2: Cost Estimate-SSRA

Task	Cost
UST removal	$40,000.00
Contaminated soils remediation, engineering and sampling (3,000 to 4,000 tonnes @ $80.00/ tonne)	$240,000.00 to $320,000.00
Floor slab, foundation and footing removal	$220,000.00
Provision for clay cap	$200,000.00 to $400,000.00
Completion of additional testing and submission of SSRA	$120,000.00
Total	**$820,000.00 to $1,100,000.00**

Note: Prices do not include applicable taxes.

3. Closure

We have provided two ends of the remedial spectrum which could involve remediation of the entire to residential versus conversion of the entire Site to parkland. It is likely that the final land-use strategy may be a combination of residential and parkland. In this event, the remedial approach would involve clean-up of the residential lands to meet Table B criteria for residential land-use and completion of an SSRA on the parklands to be retained by the City of Brantford. The remedial costs associated with the re-development of the Site to a combined residential and parkland use with vary depending on the extent and placement of the residential land. Trow would be pleased to work with you in preparing a re-development strategy which maximizes remedial cost saving opportunities.

We trust that this letter report is satisfactory for your purposes. Should you have any questions regarding this submission, please do not hesitate to contact us at (519) 754 1648.

Yours very truly,

Trow Associates Inc.

Susan Pelton-Klunder, B.E.S.
Senior Environmental Scientist
Manager, Brantford Office

for William Geddes, Dipl.Eng.
Technical Specialist
Environmental Division